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## PATENT SPECIFICATION

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## (54) METAL FRAME MEMBER

(71) We, DONALD WILLIAM EKERT and PATRICIA ANNE EKERT, both of 239 Pacific Highway, Raymond Terrace, in the State of New South Wales, Commonwealth of Australia, both Australian Citizens, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to metal frames for buildings, and provides frame members which can be readily assembled on the site without the aid of special tools. Metal frame systems are known in which the members are welded or bolted together. Welding requires special equipment and skills, while the use of nuts and bolts is both time consuming and costly. A system marketed under the name "Duraframe" comprises metal plates and studs which can be clipped together. The studs are of rectangular cross-section and the plates are channel shaped, and have tongues which engage slots on the sides of the studs. The system is not readily adaptable to variations in the floor plan, since the spacing between adjacent studs is determined by the placement of the tongues on the side of the plates. Studs and plates, being of different cross-sections, are not inter-changeable and cannot easily be manufactured on the same machinery.

One object of the present invention is to provide a metal building frame system in which the basic structural members are of a simple, roll-formable cross-section. In preferred embodiments of the invention, the basic structural elements may be used interchangeably for studs, plates, and noggings. Such minor modifications as are necessary to suit these various purposes may be carried out on site without the aid of special tools. However, it is within the scope of the invention to provide a system wherein structural members are differently finished depending on their intended use as, for example, studs, plates or noggings.

Nevertheless, all such members share a common basic cross section.

Systems according to the invention may also employ a small number of special joining members for joining structural members end to end, at T joints, or in parallel alignment where heavy loads are to be carried.

The invention resides in a metal frame system, wherein structural members of substantially rectangular channel section may be joined in a mutually perpendicular arrangement by the interaction of slots and lugs respectively carried by each member.

According to the present invention there is provided a structural member for use in the framework of a building, comprising a body portion of substantially rectangular channel section having a web joining two mutually parallel flanges, said web being provided, at each of a number of selected positions, with one or more slots and having one or more bendable lugs extending from at least one end, each of said lugs being adapted to engage a slot in the web of another similar structural member at one or more of said selected positions. Such a structural member can be used as a plate, a stud or a nogging. Preferably, the end or ends of the structural member from which the lugs project are made slightly narrower than the main body portion so that the end of the member can be fitted between the flanges of another structural member to which it is to be joined.

The web may be quite flat, or preferably has shallow longitudinal grooves in the floor of which the slots are formed. These grooves improve the rigidity of the member, and if they are on the outside of the web, they enable the tongue of an adjoining member to be bent over flush with the outer surface of the web adjacent the groove.

In the assembly of a frame system wing structural members according to the invention some structural members may be modified according to the function they will be required to perform. For example, a structural member which is to function as a

plate need not be provided with lugs, nor with a narrowed end, but will be of a simple substantially rectangular channel section provided with slots to receive and engage the lugs from a number of studs. A structural member which is to function as a nogging need not be provided with slots, but will have lugs at its end and possibly narrowed end portions, to enable it to engage the slots of its supporting studs.

It is convenient to provide the web of a structural member of the invention with a plurality of holes, to serve a variety of purposes. For example, when the member is used as a bottom plate, these holes allow any condensation which might accumulate within the member to escape. They also facilitate the attachment of the bottom plate to bearers or foundations. When the member is used as a top plate, the holes provide means for attachment of a roof. When the member is used as a stud, or as a nogging the holes allow wiring and plumbing to be passed through the member.

By way of example, a preferred embodiment of the invention is described with reference to the accompanying drawings in which:

Figure 1 is a perspective view of parts of two structural members according to the invention, ready for mutual engagement;

Figure 2 is a perspective view of portions of two studs and three noggings;

Figure 3 is an exploded view of a corner structure comprising two plates and three studs and a corner connector according to the invention;

Figure 4 shows a corner structure of Figure 3 when locked together; and

Figures 5, 6 and 7 show exemplary connectors for use in systems according to the invention.

In the illustrated embodiment of Figure 1, a T-joint between two members generally denoted as 10 and 11, is shown. For example, member 10 could be an upper plate in a wall and member 11 could be a stud. Alternatively, member 10 could be a stud and member 11 could be a nogging. Each of said members is of substantially rectangular channel section, the respective webs 12, 13 being provided with longitudinal grooves, such as 14, 15 of web 12. In the floor of each of grooves 14, 15 are a series of transverse slots such as 16, 17. Similar slots may optionally be provided in the corresponding grooves of member 11, although none are shown in Figure 1. The end 18 of member 11 is reduced slightly in width over a length approximating the width of each of the side flanges of the section. This enables end 18 to fit between the side flanges of member 10. Member 11 is provided with a pair of lugs 19, 20 which are adapted to protrude through slots 16, 17 of

member 10. The members are fastened together by bending over lugs 19, 20 to lie flush with the floor of grooves 14, 15. In the embodiment shown in Figure 1, member 10 is also provided with a reduced end portion and a pair of lugs. These may be used to form a T intersection with another member. In some embodiments, however, the reduced end portion and the lugs of member 10 will not be required. In such embodiments, a structural member lacking such an end formation may be employed.

Figure 2 shows, in part, two studs 21 and 22 and three noggings 23, 24 and 25. It will be noted that nogging 24 is of modified construction in that it is not provided with any lug-engaging slots, since it is not required to receive any abutting members. Naturally, a nogging could be provided with such slots in accordance with the invention even if they were not required to be used. The joints involving stud 21 are shown in exploded form, while the joints involving stud 22 are shown in their finally locked arrangement. It will be seen that noggings 23, 24 and 25 are alternatively upward facing and downward facing. This enables a series of noggings to be attached across a wall in horizontal alignment. In Figures 3 and 4, a corner stud comprises three structural members 30, 31 and 32. A pair of top plates 33 and 34 meet at right angles at the corner defined by structural members 30, 31 and 32. Top plates 33 and 34 have no end formations, and the whole assemblage is held together by a plate corner connector 35. Plate corner connector 35 is provided with downward facing lugs 36 to engage the web slots of top plates 33, and 34, and slots 37 to engage the end lugs of stud members 30, 31 and 32.

Figure 5 shows a flat connector which may be used to join three studs mutually back to back. Such a structure is necessary when an interior wall of a building is constructed so as to abut another wall in a T-formation.

Figure 6 is a plan view of a corner plate connector of the type shown in Figures 3 and 4, and Figure 7 is a connector for joining two plates end to end. The plate joiner comprises a generally rectangular channel sectioned member 40 of slightly larger width than the standard structural member or plate. Member 40 is provided with a number of inwardly projecting lugs 41 which engage slots on one or other of the plates to be joined and provide a rigid end to end connection for such plates.

It will be noted that various holes are provided in the webs of certain of the members shown in Figures 1 to 7. Such holes may serve a variety of purposes. For example, in Figure 1, if member 10 is to be used as a top plate, the small holes 50 in the

web of member 10 may be used for bolts or screws to attach timber rafters or other structural members. Similarly, the holes 51 and 52 in Figures 6 and 7 respectively may be used for supporting the joints formed by those members in relation to other components of the building.

The larger holes such as 53 in Figure 1, and 54 in Figure 2 may be used to accommodate plumbing and electrical wiring within a wall.

For use in frames of brick veneer buildings, structural members according to the invention may be advantageously provided with punchings or other means for attaching brick ties.

Pre-fabricated window and door frames can be built with means to engage slots or holes or other formations in frame members according to the invention.

Although the structural members according to the invention may be made from any metal having suitable mechanical properties, mild steel is to be preferred. For durability, galvanized mild steel is highly preferred.

Structural members according to the invention may conveniently be made from steel sheet. The slots are punched, and then the sheet is roll-formed into the desired channel formation. The ends may then be cut to provide the lugs, and the width of the member near its end may be reduced by pressing.

Members suitable for house frames can be roll-formed from 18 gauge steel to a rectangular channel shape of 75 mm width and 35 mm height. Grooves 15 mm wide may be provided, running the length of the member, and transverse slots 15 mm wide may be provided at intervals of 75 mm, either for the full length of the grooves, or in regions of the member where other members are likely to be joined. At each end of the member, there may be two rounded lugs of 10 mm width and 10 mm length. For a distance of approximately 40

mm from each end of the member, the overall width may be reduced by about 3mm to allow the end to be fitted between the flanges of another similar member.

#### WHAT WE CLAIM IS:—

1. A structural member for use in the framework of a building, comprising a body portion of substantially rectangular channel section having a web joining two mutually parallel flanges, said web being provided, at each of a number of selected positions, with one or more slots and having one or more bendable lugs extending from at least one end, each of said lugs being adapted to engage a slot in the web of another similar structural member at one or more of said selected positions.
2. A structural member according to Claim 1, wherein said slots are oriented transversely of said web.
3. A structural member according to Claim 2, wherein said web is provided with at least one shallow, longitudinal groove, and said slots are formed in the floor of said groove.
4. A structural member according to claim 3, having two such longitudinal grooves.
5. A building frame, comprising one or more interlocked structural members, each according to any one of the preceding claims.
6. A structural member substantially as described with reference to Figure 1 of the accompanying drawings.
7. A building frame comprising a plurality of members substantially as described with reference to one or more of the accompanying drawings.

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COMPLETE SPECIFICATION

3 SHEETS

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Sheet 1

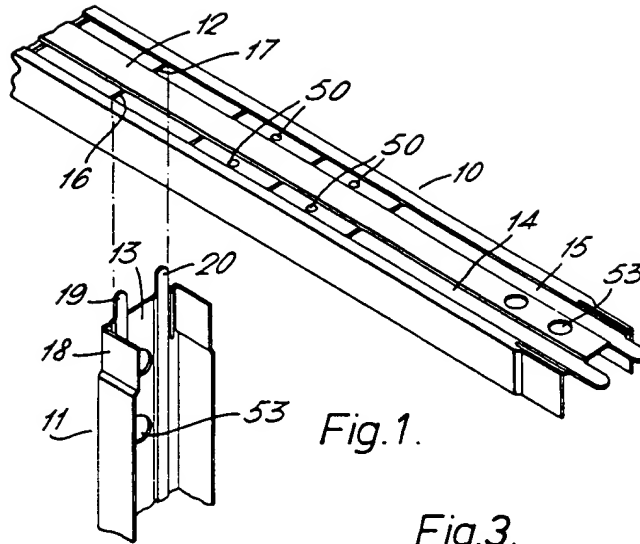


Fig. 1.

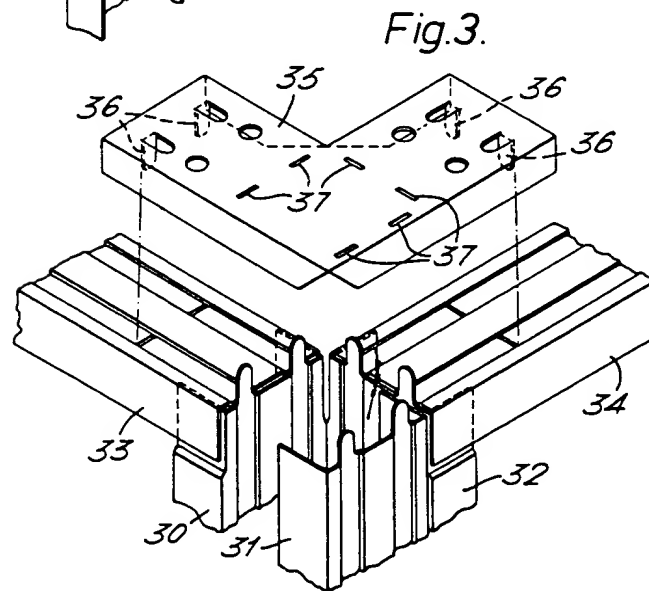


Fig. 3.

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COMPLETE SPECIFICATION

3 SHEETS

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Sheet 2

